Indoor, Outdoor Air Pollution and Asthma Risk

Exposure to **bioaerosols** including allergens, endotoxins, and mold; indoor and outdoor air pollution is associated with increased **risk of onset of asthma**.

General Information	
Broad Focus Area	Asthma
Background and Justification	Asthma is a complex disease characterized by pulmonary obstruction due to inflammatory response within central and peripheral airways. There is clear evidence that air pollutants, particularly ozone and some constituents of particulate matter, as well as transition metals, diesel exhaust, and biologicals such as endotoxin can exacerbate existing asthma, but the role of these air contaminants in the induction of asthma is less clear.[1] Currently available databases are not able to answer directly questions about the effects of chronic aeroallergen exposures on asthma; nor are they able to examine the effects of chronic air pollutant and aeroallergen exposures on asthma incidence simultaneously. These examinations will require the collection of new data and will be best studied in a large prospective cohort study design, which should include children of different ethnicities living across the United States under varied housing, socioeconomic and geographic conditions.
Prevalence/ Incidence	Nine million children less than 18 years of age are estimated to have asthma.[2] Among children, it is the most common chronic illness.[3] The prevalence of asthma increased from 35 to 62 per 1,000 children aged 0 to 17 years between 1980 and 1996.[4] Exposure to bioaerosols and outdoor air pollution is ubiquitous but varies by location and time.
Economic Impact	In 1997, the annual estimated cost of pediatric asthma in the US was $6.6 billion.[5] By 2002, the total cost of asthma was estimated at $14 billion.[6] The more severe forms of asthma account for a disproportionate amount of the total direct costs; one study estimated that less than 20% of asthmatics account for over 80% of the direct costs.[7] Asthma also poses a substantial and increasing public health burden in lost time from school and usual activities and in health care utilization.

Exposure Measures			Outcome Measures	
Primary/ Maternal	Exposure to indoor and outdoor air pollution and bioaerosols, including allergens, endotoxin, mold		***Primary/ Maternal***	
Methods	Environmental sampling for indoor and outdoor air pollution measures (e.g., PM, diesel exhaust, NO_2, and various allergens including fungal allergen); blood samples; urine samples; other physical sampling; interview/questionnaire		Methods	
Life Stage	Prenatal through birth		Life Stage	
Primary/Child	Exposure to indoor and outdoor air pollution and bioaerosols,		***Primary/Child***	Asthma: - allergic sensitization

	including allergens, endotoxin, mold			- airway reactivity - immune system function (e.g., lymphocytes, cytokines, IgE, interleukins)
Methods	- Environmental air samples inside and outside home, school and daycare (e.g., mold, endotoxins, allergens, environmental tobacco smoke) - Other exposure information (housing and neighborhood characteristics, product usage in home, child time activity patterns (GPS), local agency air quality reports) - Biological samples (exposure markers in blood, urine, etc.)		Methods	- Examination and interview by medical professional (e.g., skin sensitivity test) - Medical record review - Blood samples
Life Stage	Periodic, birth through year 20		Life Stage	Periodic, birth through year 20

Important Confounders/Covariates	
Particulate matter	Elevated levels of PM can exacerbate existing asthma, but not promote the induction of asthma; PM promotes the formation of reactive oxygen species leading to airflow limitation and symptoms of asthma [8]
Smoking	Associations with outdoor ozone and pollens were seen mainly among persons with low levels of exposure to indoor bioaerosols (<1800 spores/m3) or with no ETS exposure [9]
Health care access	Poor health care access in inner cities, especially among African Americans and Hispanics, exacerbates the risk of viral infections contributing to asthma attacks and deaths. [10, 11, 12]

Population of Interest		Estimated Effect that is Detectable
All children		The smallest detectable relative risk is approximately 1.2. This power estimate assumes a sample size of 100,000 at age of diagnosis, an asthma incidence of 5%, and a cut-off value for "high" exposure based on the upper 5th percentile of NCS subjects (i.e., a proportion exposed of 0.05). It assumes only a main effects model based on exposure to a single factor (e.g., a single pollutant) without consideration of interactions with other exposures, genetics, family history, etc.[13]

Other Design Issues	
Ethical/Burden Considerations	The study also will need to have a formal strategy and process for effective communication of the results of environmental monitoring to the child's parents along with appropriate and feasible recommendations regarding the correction of any unhealthful environmental findings. Repeated tests are potentially burdensome
Cost/Complexity of Data Collection	Repeated waves of environmental exposure assessment can be both

	costly and burdensome.
Need for Community Involvement	Daycare and school cooperation would be required for some of the intended measures.

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